

ABSTRACT

Hydraulic engine valve actuation methods for internal combustion engines having improved energy efficiency. In hydraulic engine valve operating systems using spring returns for valve closure, the spring force is a minimum when the valve is closed and a maximum at the maximum lift. The present invention takes advantage of this difference by using a valve opening hydraulic force which is greater than the spring force when the valve is closed and less than the spring force when the valve is open at its maximum lift. The valve actuator is controlled to allow the valve, when opening, to overshoot the equilibrium condition. During the overshoot, the hydraulic actuator backfills with actuating fluid at its normal actuating pressure. When the valve velocity decays to zero or near zero, the flow of hydraulic fluid to (and from) the valve actuator may be cut off, capturing the valve substantially at the overshoot position.